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Mayflies (Insecta: Ephemeroptera) in Chiriquí Province, Republic of Panamá, with a new distributional record for *Camelobaetidius kondratieffi* Lugo-Ortiz & McCafferty, 1995 (Baetidae)

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Abstract: The mayfly fauna of samples collected in Chiriquí Province of western Panamá are listed, including the first report of *Camelobaetidius kondratieffi* Lugo-Ortiz & McCafferty, 1995 from the Republic of Panamá. This species was previously reported only from Belize, Guatemala and Costa Rica.

Key words: Ephemeroptera, Baetidae, *Camelobaetidius*, Neotropical, Central America, Panamá

A checklist of the Central American Ephemeroptera fauna was provided by McCafferty and Lugo-Ortiz (1996), but few country-specific checklists have been compiled (e.g., Flowers 1992 for Costa Rica and Panamá; McCafferty et al. 2004 for Guatemala). Examination of existing collections and additional collecting efforts in Central America have allowed further documentation of more widespread distributions (Lugo-Ortiz and McCafferty 1996; Baumgartner and McCafferty 2000; Wiersema and Baumgartner 2000; McCafferty 2011) and descriptions of new taxa (McCafferty and Randolph 2000; Wiersema and Baumgartner 2000). Flowers (1991) recognized 82 taxa of Ephemeroptera in collections from northwestern Panamá, but he only provided species names for ten taxa; the rest were left at genus level or as morphospecies (e.g., *Tricorythodes* A); therefore, there are currently only 21 named Ephemeroptera species known from Panamá (Flowers 1992; Lugo-Ortiz and McCafferty 1996; McCafferty and Lugo-Ortiz 1996). This leaves the Panamanian Ephemeroptera fauna rather poorly known in comparison to Costa Rica, Panamá's immediate neighbor in Central America, which has 74 named species registered (Flowers 1992; Lugo-Ortiz and McCafferty 1996; McCafferty and Lugo-Ortiz 1996; Wiersema and Baumgartner 2000).

One mayfly genus, *Camelobaetidius*, is common in Central America. This genus is differentiated from all other Baetidae by its spatulate claws. In northwestern Panamá, Flowers (1991, 1992) recognized six morphospecies of *Dactylobaetis* (= *Camelobaetidius*), and the only species of the genus to be reported from Panamá is *Camelobaetidius warreni* (Traver & Edmunds) (McCafferty 2011), so it is likely that additional species would be recognized and confirmed in Panamá as further collecting is conducted and taxonomy improves.

Streams within the Río Caldera basin in western Panamá (Figure 1; Table 1) were sampled for benthic macroinvertebrates during March of 2001, 2002, and

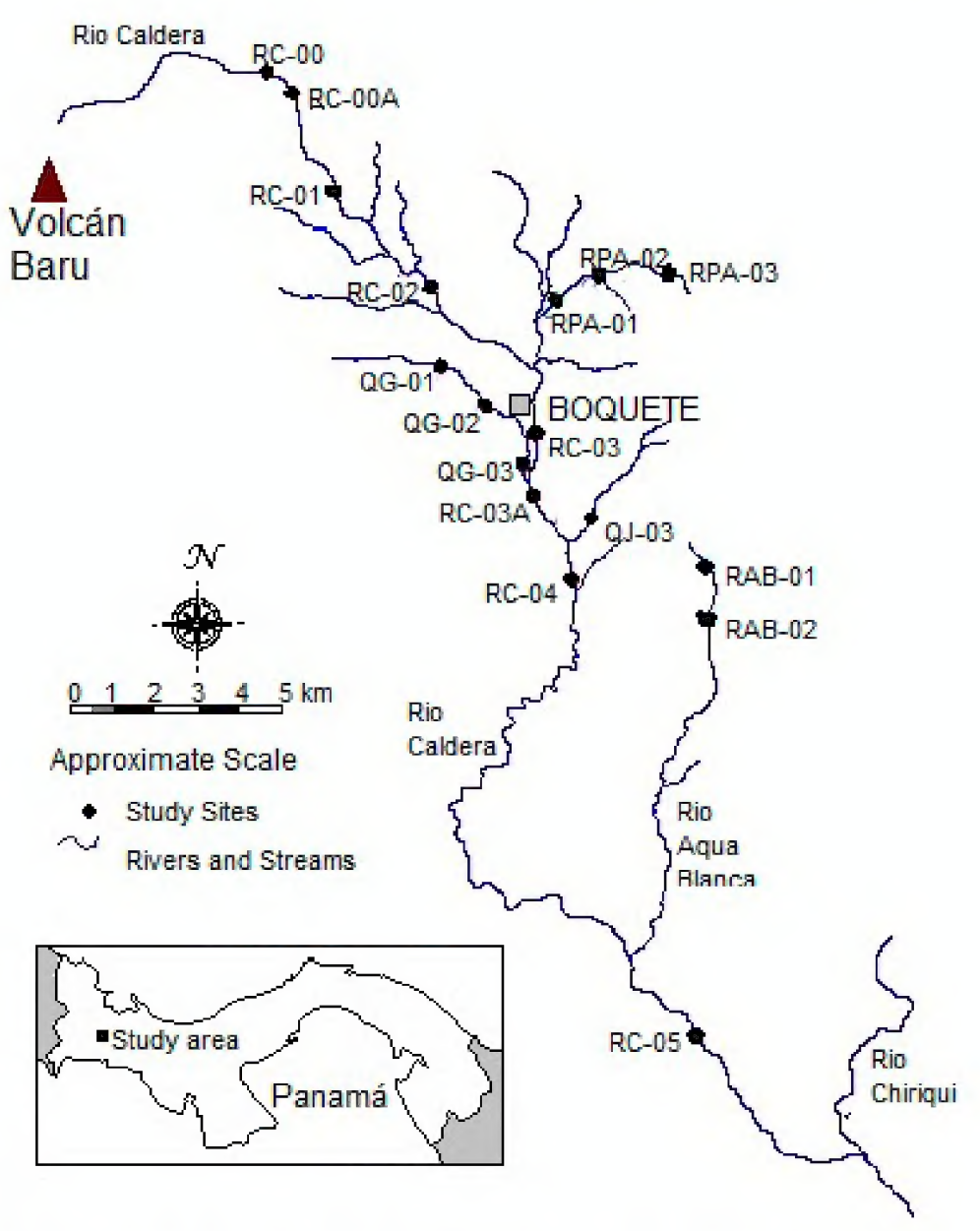

Figure 1. Map of Study Sites in the Río Caldera Basin, Republic of Panamá. Study sites on Quebrada Horqueta and Río David not shown.

Table 1. Sites in the Río Caldera basin and the Río David, Chiriquí Province, Republic of Panamá.

Stream	Site	Elevation (m above sea level)	Years sampled		
			2001	2002	2004
Rio Caldera	00	1,890	X		
	00A	1,674		X	X
	01	1,614	X	X	X
	02	1,376	X	X	X
	03	1,181	X		
	03A	1,061		X	X
	04	1,018	X	X	X
	04B	746			X
	5	360	X	X	X
Rio Palo Alto	01	1,629	X	X	X
	02	1,346	X	X	X
	03	1,243		X	X
Quebrada Grande	01	1,218	X	X	
	02	1,194	X	X	
	03	1,083		X	
Quebrada Jaramillo	01	1,466		X	X
	02	1,324	X	X	
	03	1,093	X	X	
Quebrada Horqueta	01	1,403	X	X	
	02	1,332	X	X	
Rio Agua Blanca	01	1,279	X	X	
	02	1,002	X	X	
Rio David	01	943			X

2004 using three-minute, timed kick samples. Substrate at the sites ranged from sand to boulders, with cobble predominant. Flow was generally swift in areas where the kick samples were collected. Riparian vegetation was dense, and consisted mainly of shrubs and trees.

Ten sites were sampled in 2001 with approximately 50 organisms sorted from the debris at the site. Nineteen sites were sampled in 2002, and seventeen sites were sampled in 2004, each with all organisms sorted from each sample in the laboratory. In addition, in 2004, a sample was collected at one site in the Río David near Boquete.

All sorted organisms were preserved in 90% denatured ethanol and identified to the lowest practical taxonomic level using available literature (Allen 1978; Cohen and Allen 1978; Waltz and McCafferty 1985; Flowers 1992; Edmunds and Waltz 1996; Baumgartner and McCafferty 2000; McCafferty and Randolph 2000; Domínguez et al. 2001; Heckman 2002). Individuals in the genera *Baetis*, *Farrodes*, *Leptohyphes*, *Thraulodes* and *Tricorythodes* could not be identified to species because reliable, up-to-date species-level keys do not exist for larvae of these genera. Adult females of *Leptohyphes* and *Thraulodes* were also collected at black light at a couple sites. Voucher specimens of each taxon have been deposited

Table 2. Presence of mayfly taxa at sites in the Río Caldera basin and the Río David, Chiriquí Province, Republic of Panamá.

		Baetidae							Heptageniidae	Leptohyphidae		Leptophlebiidae	
Stream	Site	*Baetis* sp.	*Baetodes* sp. nr. *velmae*	*Camelobaetidius kondratieffi* Lugo-Ortiz & McCafferty	*Fallceon quilleri* (Dodds)	*Moribaetis macafferti* Waltz	*Moribaetis maculipennis* (Flowers)	*Moribaetis salvini* (Eaton)	*Epeorus packeri* Allen & Cohen	*Leptohyphes zalope* Traver	*Tricorythodes* sp.	*Farrodes* sp.	*Thraulodes* sp.
Rio Caldera	00					X		X					
	00A		X	X		X		X			X		
	01		X	X		X		X			X		
	02		X	X				X			X		
	03		X	X		X		X					
	03A	X	X	X	X	X		X					
	04	X	X	X	X		X	X			X		X
	04B			X	X					X	X		
	5		X	X				X		X	X		X
Rio Palo Alto	01	X	X	X	X	X	X	X	X		X		X
	02	X	X	X	X	X	X	X		X			X
	03		X	X	X	X		X			X		X
Quebrada Grande	01		X	X				X		X			X
	02		X	X				X			X		
	03		X	X				X					
Quebrada Jaramillo	01		X	X		X		X		X			X
	02		X					X		X		X	X
	03	X	X	X	X			X		X	X		X
Quebrada Horqueta	01		X	X				X					
	02	X	X	X				X		X			X
Rio Agua Blanca	01	X	X	X		X		X		X		X	X
	02		X	X		X		X		X	X		X
Rio David	01	X		X				X		X	X		X

in the publicly available Reference Collection of GEI Consultants, Inc.

Mayflies were represented by 12 distinct taxa from four families (Table 2), comprising up to 10 taxa at a site, up to 30.1% of the total taxa richness, and up to 75.8% of the total number of organisms collected at a site in all three years. The report of *Camelobaetidius kondratieffi* Lugo-Ortiz & McCafferty, 1995 represents a new country record, and the precise collection data for all examined specimens are included in Appendix 1. Since the other mayfly taxa have already been registered from Panamá (Flowers 1991), detailed collection data are not provided here but are available upon request from the authors.

All specimens of *Camelobaetidius* that we collected in the Río Caldera and Río David basins fit the description of *C. kondratieffi* in Lugo-Ortiz and McCafferty (1995). This species has a large number of denticles on the tarsal claws and weakly pectinate setae on the anterodorsal margin of the labrum. These characters separate *C. kondratieffi* from other known Central American species of the genus.

This report of *C. kondratieffi* in Panamá extends its distribution southward from its previously known distribution (Figure 2) from Belize and Guatemala south to Puntarenas state in Costa Rica (Lugo-Ortiz and McCafferty 1995, 1996; Wiersema and Baumgartner 2000; McCafferty et al. 2004), which borders Panamá's Chiriquí Province to the west. Given the identification of six morphospecies of *Camelobaetidius* from Panamá in Flowers (1991, 1992), further collecting will certainly result in additional species of this genus being registered from Panamá besides *C. warreni* and *C. kondratieffi*.

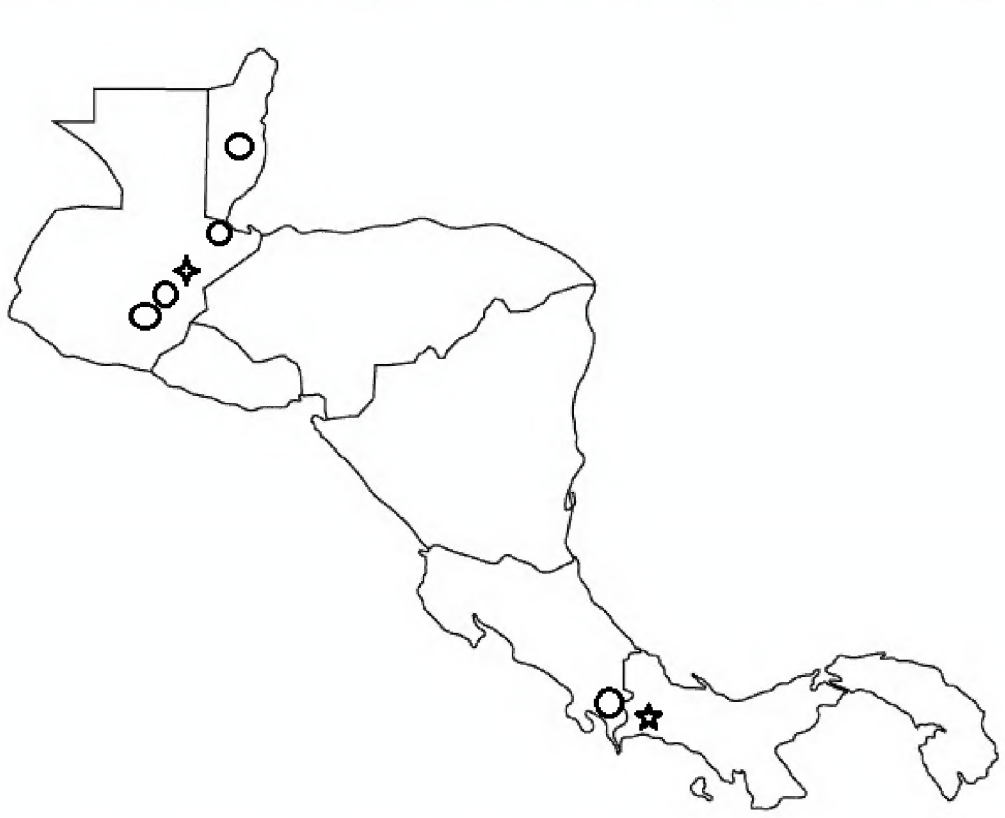

Figure 2. Distribution of *Camelobaetidius kondratieffi* Lugo-Ortiz & McCafferty. Four-pointed star is the type locality; open circles represent previously registered localities; five-pointed star is new locality record in Panamá.

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Appendix 1

Collection data for new country record of *Camelobaetidius kondratieffi* Waltz & McCafferty in Panamá. All collections were made by Steven P. Canton.

PANAMÁ: Chiriquí Province:
Río Caldera (RC-00a), 08.84222° N, 082.48103° W, 56 larvae, 23 March 2002, 12 larvae, 23 March 2004; Río Caldera (RC-01), 08.82475° N, 082.47239° W, 5 larvae, 16 March 2001, 91 larvae, 23 March 2002, 20 larvae, 23 March 2004; Río Caldera (RC-02), 08.80397° N, 082.45189° W, 2 larvae, 2 April 2001, 2 larvae, 23 March 2001, 12 larvae, 23 March 2004; Río Caldera (RC-03), 08.77606° N, 082.43044° W, 3 larvae, 2 April 2001; Río Caldera (RC-03a), 08.76342° N, 082.43186° W, 23 larvae, 26 March 2002, 10 larvae, 24 March 2004; Río Caldera (RC-04), 08.47169° N, 082.42169° W,15 larvae, 2 April 2001, 171 larvae, 16 March 2002, 9 larvae, 22 March 2004; Río Caldera (RC-04b), 08.69589° N, 082.44506° W, 5 larvae, 27 March 2004; Río Caldera (RC-05), 08.64608° N, 082.39444° W, 4 larvae, 27 March 2002. 4 larvae, 22 March 2004; Río Palo Alto (RPA-01), 08.80617° N, 082.41767° W, 30 larvae, 19 March 2002, 3 larvae, 23 March 2004; Río Palo Alto (RPA-02), 08.80606° N, 082.41775° W, 1 larva, 19 March 2002, 3 larvae, 23 March 2004; Río Palo Alto (RPA-03), 08.80261° N, 082.42514° W, 4 larvae, 23 March 2004; Quebrada Grande (QG-01), 08.78444° N, 082.44497° W, 2 larvae, 27 March 2001; Quebrada Grande (QG-02), 08.78072° N, 082.44181° W, 2 larvae, 27 March 2002; Quebrada Jaramillo (QJ-01), 08.77383° N, 082.40514° W, 1 larva, 16 March 2002; Quebrada Jaramillo (QJ-03), 08.75472° N, 082.41844° W, 16 larvae, 16 March 2002, 18 larvae, 22 March 2004; Quebrada Horqueta (QH-01), 08.81619° N, 082.45861° W, 2 larvae, 23 March 2002, 23 larvae, 23 March 2004; QuebradaHorqueta (QH-02), 08.80878° N, 082.45569° W, 3 larvae, 23 March 2002, 48 larvae, 23 March 2004; Río Agua Blanca (RAB-02), 08.73208° N, 082.42594° W, 1 larva, 27 March 2002; Río David (RD-01), 08.68414° N, 082.50875° W, 6 larvae, 24 March 2004.